

**U.S. DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT**

**PRESENTATION TO
THE NUCLEAR WASTE TECHNICAL REVIEW BOARD**

**SUBJECT: USE OF PERFORMANCE
ASSESSMENT IN THE MINED
GEOLOGIC DISPOSAL SYSTEM:
PROGRAMMATIC ASPECTS**

PRESENTER: DR. J. RUSSELL DYER

**PRESENTER'S TITLE
AND ORGANIZATION: CHIEF, TECHNICAL ANALYSIS BRANCH
YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT OFFICE
LAS VEGAS, NEVADA**

**PRESENTER'S
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**ARLINGTON, VIRGINIA
MAY 20-21, 1991**

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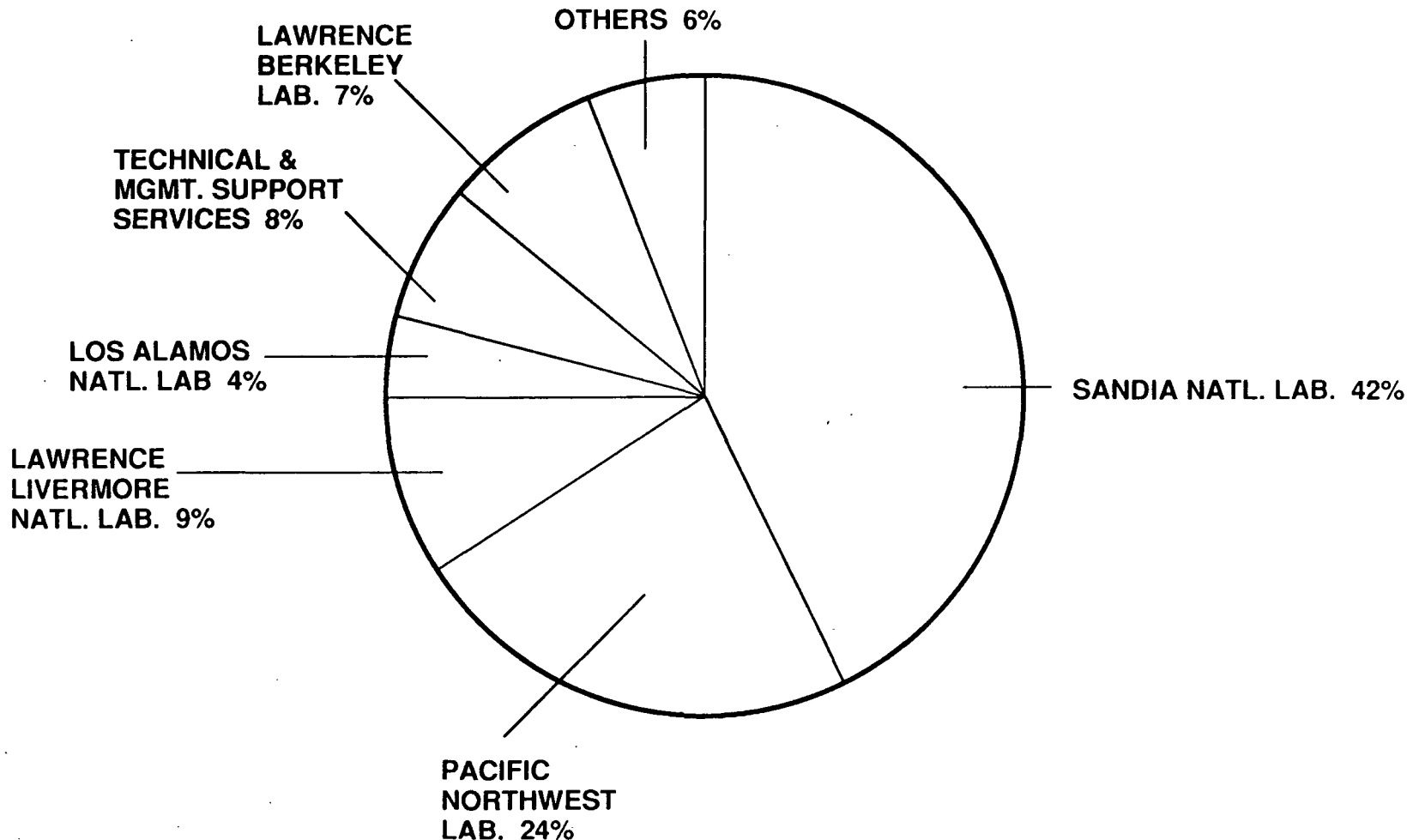
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* NOT FUNDED IN FY 1991

FY91 PA PARTICIPANTS AS A PERCENTAGE OF PA BUDGET



FY-1990 ACCOMPLISHMENTS - ANALYSES AND EVALUATIONS

- o COMPLETED PACE ANALYSES**
- o DEVELOPED SCENARIO EVENT TREES AND
SELECTED SCENARIOS FOR EARLY SITE SUITABILITY
EVALUATIONS**
- o INITIATED GROUND-WATER FLOW CALCULATIONS
FOR CALICO HILLS STUDY**
- o CONTINUED SUPPORT OF EXPLORATORY STUDIES
FACILITY (ESF) AND REPOSITORY DESIGN
ALTERNATIVE STUDIES**
- o ANALYZED PERFORMANCE OF BOROSILICATE GLASS
WASTE FORM**

PACE = PERFORMANCE ASSESSMENT CALCULATIONAL EXERCISE

FY-1990 ACCOMPLISHMENTS - RESEARCH AND DEVELOPMENT

- o COMPLETED PRELIMINARY TOTAL SYSTEM PERFORMANCE ASSESSMENT COMPUTER CODES**
- o CONTINUED DEVELOPMENT OF PERFORMANCE ASSESSMENT COMPUTER CODES AND MODELS**
- o INITIATED LABORATORY EXPERIMENTS OF UNSATURATED FRACTURE FLOW AND TRANSPORT**
- o PARTICIPATED IN INTRAVAL AND PSACOIN**
- o FORMULATED GENERAL MODEL VALIDATION APPROACH**
- o INITIATED SOFTWARE AND EXPERIMENTAL QA PROGRAM AND PROCEDURES**

INTRAVAL = INTERNATIONAL TRANSPORT CODE VALIDATION

**PSACOIN = PROBABILISTIC SYSTEMS ASSESSMENT CODE
INTERCOMPARISON**

ASSESSING COMPLIANCE WITH REGULATORY PERFORMANCE OBJECTIVES

1. DEVELOP SCENARIOS:

- **IDENTIFY SIGNIFICANT FEATURES, EVENTS AND PROCESSES**
- **FORMULATE SCENARIO CLASSES**
- **SELECT SCENARIOS FOR ANALYSES**

2. ESTIMATE PROBABILITIES

3. DEVELOP MODELS:

- **FORMULATE CONCEPTUAL MODELS**
- **SELECT MATHEMATICAL MODELS AND COMPUTER CODES**

4. IDENTIFY PARAMETER VALUES AND DISTRIBUTIONS

5. CONDUCT ANALYSES

6. INTERPRET AND EVALUATE RESULTS

SITE CHARACTERIZATION PLAN SECTION 8.3.5 PERFORMANCE ASSESSMENT

PRECLOSURE PERFORMANCE ASSESSMENT

8.3.5.1 STRATEGY

8.3.5.2 WASTE RETRIEVABILITY

8.3.5.3 PUBLIC RADIOLOGICAL SAFETY

8.3.5.4 WORKER RADIOLOGICAL SAFETY

8.3.5.5 ACCIDENTAL RELEASES

**8.3.5.6 HIGHER-LEVEL FINDINGS – PRECLOSURE
RADIOLOGICAL SAFETY**

**8.3.5.7 HIGHER-LEVEL FINDINGS – EASE AND COST OF
CONSTRUCTION**

SITE CHARACTERIZATION PLAN SECTION 8.3.5 PERFORMANCE ASSESSMENT

(CONTINUED)

POSTCLOSURE PERFORMANCE ASSESSMENT

8.3.5.8 STRATEGY

8.3.5.9 CONTAINMENT BY WASTE PACKAGE

8.3.5.10 ENGINEERED BARRIER SYSTEM RELEASE RATES

8.3.5.11 SEAL PERFORMANCE

8.3.5.12 GROUND-WATER TRAVEL TIME

8.3.5.13 TOTAL SYSTEM PERFORMANCE

8.3.5.14 INDIVIDUAL PROTECTION

8.3.5.15 GROUND WATER PROTECTION

8.3.5.16 PERFORMANCE CONFIRMATION

**SITE CHARACTERIZATION PLAN
SECTION 8.3.5
PERFORMANCE ASSESSMENT**

(CONTINUED)

POSTCLOSURE PERFORMANCE ASSESSMENT

8.3.5.17 NRC SITING CRITERIA

8.3.5.18 HIGHER-LEVEL FINDINGS – POSTCLOSURE

8.3.5.19 COMPLETED ANALYTICAL TECHNIQUES

**8.3.5.20 ANALYTICAL TECHNIQUES REQUIRING
DEVELOPMENT**

PERFORMANCE ASSESSMENT WBS STRUCTURE

- 1.2.1 SYSTEMS**
- 1.2.1.4 PERFORMANCE ASSESSMENT**
- 1.2.1.4.1 TOTAL-SYSTEM PERFORMANCE ASSESSMENT**
- 1.2.1.4.2 WASTE PACKAGE PERFORMANCE ASSESSMENT**
- 1.2.1.4.3 REPOSITORY PERFORMANCE ASSESSMENT**
- 1.2.1.4.4 SITE PERFORMANCE ASSESSMENT**
- 1.2.1.4.5 GEOCHEMICAL MODELING AND DATA BASE DEV.**
- 1.2.1.4.6 DEVELOPMENT AND VALIDATION OF FLOW AND
TRANSPORT MODELS**
- 1.2.1.4.7 SUPPORTING CALCULATIONS FOR POSTCLOSURE
PERFORMANCE ASSESSMENT**
- 1.2.1.4.8 PERFORMANCE CONFIRMATION**
- 1.2.1.4.9 DEVELOPMENT AND VERIFICATION OF FLOW AND
TRANSPORT CODES**

PERFORMANCE ASSESSMENT ELEMENTS OF THE WORK BREAK DOWN STRUCTURE

1.2.1.4.1 TOTAL SYSTEM (TS) (SNL, PNL, GOLDR)

- o INTEGRATE PHYSICAL PROCESS SUBMODELS AND DATA INTO COMPUTATIONAL MODELS FOR PREDICTION OF POSTCLOSURE PERFORMANCE (INCLUDING UNCERTAINTIES)**
- o ASSESS COMPLIANCE WITH OVERALL SYSTEM PERFORMANCE OBJECTIVE (10 CFR 60.112)**

PERFORMANCE ASSESSMENT ELEMENTS OF THE WORK BREAK DOWN STRUCTURE

(CONTINUED)

1.2.1.4.2 WASTE PACKAGE PA (LLNL, PNL, LBL/UCB, CHO)

- o INTEGRATE PHYSICAL PROCESS SUBMODELS AND DATA INTO COMPUTATIONAL MODELS**
 - PREDICTION OF LONG-TERM WP PERFORMANCE**
 - * SINGLE PACKAGE PERFORMANCE**
 - * PERFORMANCE OF THE SET OF ALL WPs IN THE REPOSITORY (INCLUDING UNCERTAINTIES)**
- o ASSESS COMPLIANCE OF PERFORMANCE OBJECTIVES FOR THE WPs AND EBS (10 CFR 60.113)**
- o PROVIDE SUPPORT TO DESIGN OPTIMIZATION STUDIES**
- o PROVIDE A SOURCE TERM FOR THE TOTAL SYSTEM PA**

PERFORMANCE ASSESSMENT ELEMENTS OF THE WORK BREAK DOWN STRUCTURE

(CONTINUED)

1.2.1.4.3 REPOSITORY PA (SNL)

- o INTEGRATE PHYSICAL PROCESS SUBMODELS AND DATA INTO COMPUTATIONAL MODELS FOR PREDICTION OF REPOSITORY PERFORMANCE (INCLUDING UNCERTAINTIES)**
- o ASSESS COMPLIANCE WITH RADIOLOGICAL SAFETY, WASTE RETRIEVAL, AND SEALING REQUIREMENTS (10 CFR 60)**

1.2.1.4.4 SITE PA (SNL, LBL, PNL, USGS, LANL, LLNL)

- o INTEGRATE PHYSICAL PROCESS SUBMODELS AND DATA INTO COMPUTATIONAL MODELS FOR PREDICTION OF PERFORMANCE OF SITE (INCLUDING UNCERTAINTIES)**
- o ASSESS COMPLIANCE WITH REQUIREMENTS FOR GWTT (10 CFR 60.113 (a) (2))**

PERFORMANCE ASSESSMENT ELEMENTS OF THE WORK BREAK DOWN STRUCTURE

(CONTINUED)

1.2.1.4.5 GEOCHEMICAL MODELING & DATA BASE DEVELOPMENT (LLNL)

- o DEVELOP AND VERIFY COMPUTER CODES AND DATA BASES USED IN ASSESSMENT OF THE PERFORMANCE OF MGDS FOR PREDICTION OF WP ENVIRONMENT, SITE GEOCHEMISTRY, AND WP PERFORMANCE**

PERFORMANCE ASSESSMENT ELEMENTS OF THE WORK BREAK DOWN STRUCTURE

(CONTINUED)

1.2.1.4.6 DEVELOPMENT AND VALIDATION OF FLOW AND TRANSPORT MODELS (SNL, LBL, USGS, LLNL, PNL, GOLDER, LANL)

o DEVELOP AND VALIDATE CALCULATIONAL MODELS

- USED PRIMARILY IN ASSESSMENTS OF PERFORMANCE FOR THE RESOLUTION OF ISSUES

1.2 (INDIVIDUAL PROTECTION)

1.3 (GROUND-WATER PROTECTION)

1.6 (PRE-WASTE-EMPLACEMENT GWTT)

1.8 (FAVORABLE AND UNFAVORABLE CONDITIONS
OF 10 CFR 60)

1.9 (HIGHER-LEVEL FINDINGS OF 10 CFR 960)

- DESCRIBE FLUID FLOW OR THE TRANSPORT OF ENERGY OR RADIONUCLIDES

- ARE NOT USED EXCLUSIVELY IN THE RESOLUTION OF A SINGLE ISSUE

PERFORMANCE ASSESSMENT ELEMENTS OF THE WORK BREAK DOWN STRUCTURE

(CONTINUED)

1.2.1.4.7 SUPPORTING CALCULATIONS FOR POSTCLOSURE PERFORMANCE ANALYSES (SNL, PNL, LANL, LBL, LLNL, USGS)

- o PROVIDE DOCUMENTATION AND RESULTS OF CALCULATIONS USED IN ANALYSES OF POSTCLOSURE PERFORMANCE THAT SUPPORT DESIGN EFFORTS**
- o CONTRIBUTE TO THE RESOLUTION OF ISSUE 1.3 (GROUND-WATER PROTECTION)**
- o INDIRECTLY SUPPORT ACTIVITIES CARRIED OUT UNDER OTHER PA WBS ELEMENTS**

1.2.1.4.8 PERFORMANCE CONFIRMATION (SNL, LANL, LLNL, USGS)

- o ASSESS AND ENSURE COMPLIANCE OF THE YUCCA MOUNTAIN MGDS PERFORMANCE CONFIRMATION PROGRAM WITH REQUIREMENTS (10 CFR 60.137)**

PERFORMANCE ASSESSMENT ELEMENTS OF THE WORK BREAK DOWN STRUCTURE

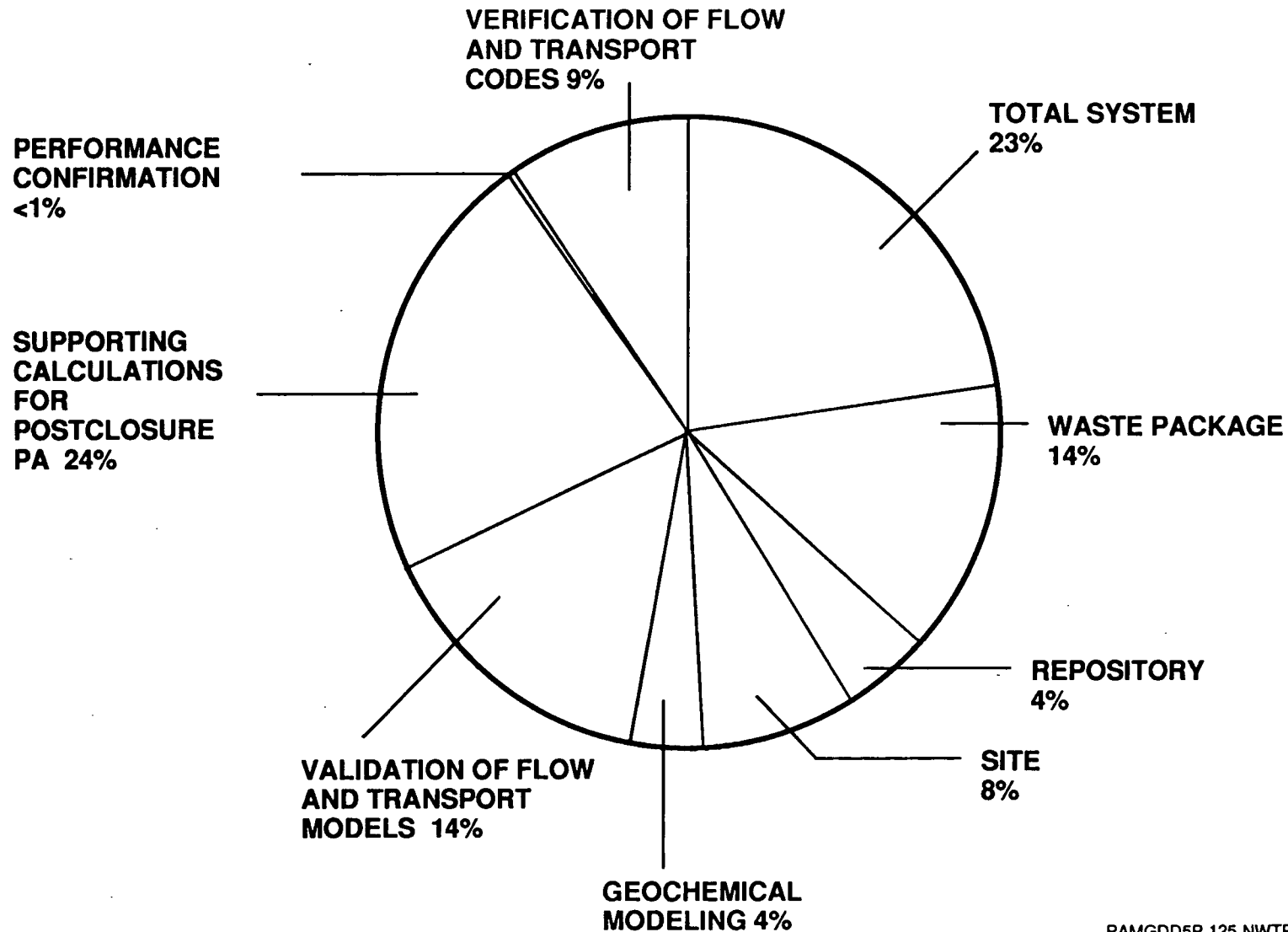
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1.2.1.4.9 DEVELOPMENT AND VERIFICATION OF FLOW AND TRANSPORT CODES (SNL, PNL, LBL, LANL, LLNL)

o DEVELOP AND VERIFY COMPUTER CODES

- USED PRIMARILY IN ASSESSMENTS OF PERFORMANCE
FOR THE RESOLUTION OF ISSUES**
 - 1.1 (TOTAL SYSTEM PERFORMANCE)**
 - 1.2 (INDIVIDUAL PROTECTION)**
 - 1.3 (GROUND-WATER PROTECTION)**
 - 1.6 (PRE-WASTE-EMPLACEMENT GWTT)**
 - 1.8 (FAVORABLE AND UNFAVORABLE CONDITIONS OF 10 CFR 60)**
 - 1.9 (HIGHER-LEVEL FINDINGS OF 10 CFR 960)**
- MODEL FLUID FLOW OR THE TRANSPORT OF ENERGY
OR RADIONUCLIDES**
- NOT USED EXCLUSIVELY IN THE RESOLUTION OF
A SINGLE ISSUE**

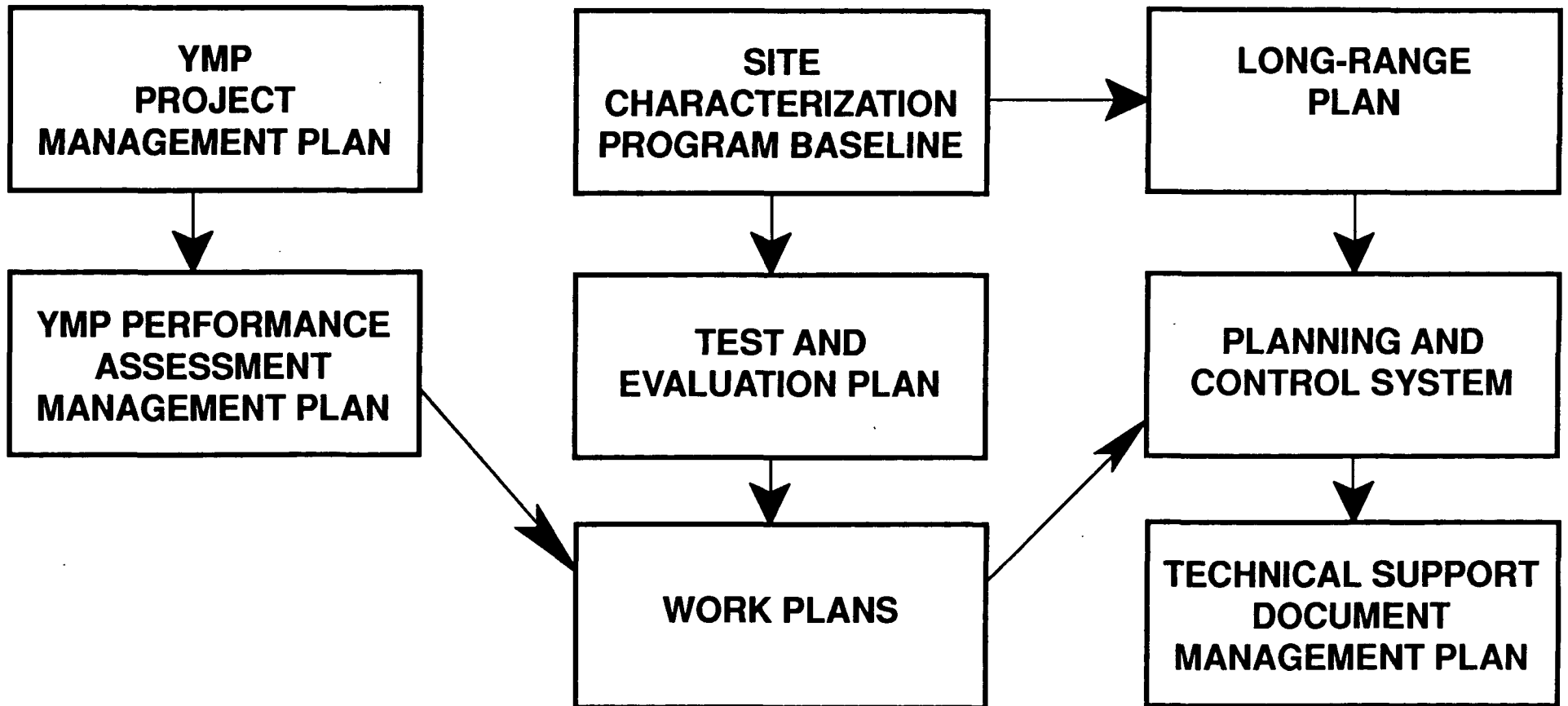
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PERFORMANCE ASSESSMENT DOCUMENT HIERARCHY

WHO

WHAT



OBSOLETE: OCRWM PERFORMANCE ASSESSMENT MANAGEMENT PLAN
OCRWM PERFORMANCE ASSESSMENT IMPLEMENTATION PLAN